

## PREY SELECTION OF COMMON BARN-OWLS ON ISLANDS AND MAINLAND SITES

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**ABSTRACT.**—Data from the literature and a recent collection of Common Barn-Owl (*Tyto alba*) pellets from Block Island, Rhode Island, were used to assess the relative numbers of birds and non-avian vertebrates taken by this owl on islands and mainland sites. Our analysis supports the hypothesis that barn-owl diets include proportionately more birds (both species and individuals) on islands than at mainland sites. The percent of bird species and individual birds in the diet decreases from the equator to 54°N. Possible causes for island vs. mainland diets and latitudinal trends are discussed.

The interaction between the Common Barn-Owl (*Tyto alba*) and its prey is well documented. Published studies deal with economic aspects (Bendire 1895; Errington 1932; Wallace 1950), population ecology (Davis 1959; Otteni et al. 1972; Herrera and Jaksić 1980), and range extensions of mammalian prey (Kirkpatrick and Conway 1947; Stickel and Stickel 1948; Baker 1953; Parmalee 1954). This owl is believed to specialize on mammalian prey, but Johnston (1974: 172) reported a high percentage of bird species in barn-owl pellets from Grand Cayman Island, BWI. From that study and two other island reports available then, he proposed that "on some islands . . . where small mammalian prey is reduced in diversity and total numbers, the barn-owl becomes alternatively a significant predator of birds and other non-mammalian vertebrates." We now test that hypothesis by using data from additional published accounts of barn-owl diets on islands and mainland sites. While examining the data from those locations, we developed an additional hypothesis that barn-owl prey on more northerly islands includes fewer birds than on islands closer to the equator.

### MATERIALS AND METHODS

A search of the literature from the northern hemisphere yielded quantitative pellet analyses from 23 island sites occurring from the Galapagos Islands (0°) to Sheppey Isle (British Isles, 54°N) and from 50 mainland sites, mostly in the United States, but also from some localities in Spain, Poland, and Italy. Unpublished data from several islands in the British Isles were obtained from David E. Glue, as were unpublished data from Martha's Vineyard, Massachusetts (G. Jones and K. Driscoll). In Appendix I are unpublished data from Block Island, Rhode Island. Data extracted from these accounts are used in our statistical analyses (Mann-Whitney U-Test) and in the regression analyses.

To test the hypothesis suggested by Johnston (1974) that barn-owls take proportionately more birds on islands than on the mainland, pellet data from the literature were examined and compared in two ways: 1) by considering

the percent of *bird species* among all the vertebrate species captured, and 2) by considering the percent of all *individual birds* vs. individuals of all non-avian vertebrate prey.

### RESULTS AND DISCUSSION

**Prey Selection on Islands.** Most previous dietary studies of barn-owls from mainland sites have shown a preponderance of mammalian prey. Mammal prey species from the 50 mainland sites examined here constituted a mean of 92.4% (SD = 8.29) of the total vertebrate diet. Despite this preponderance of small mammal prey species, the mainland barn-owls took some small birds and, even less frequently, reptiles, amphibians, and insects. By contrast, on 23 island sites mammal species constituted a mean of only 60.5% (SD = 25.47).

The number of bird species as a percent of the total vertebrate prey species from islands ( $\bar{X} = 38.6$ ) is significantly greater than values from mainland sites ( $\bar{X} = 19.9$ ) (Table 1). Although the *number* of bird species *per se* does not differ significantly between islands and the mainland (Table 1), barn-owls took fewer mammal species on islands than on the mainland, thus making the proportion of bird species taken on islands higher. We also examined published data on the total number of individual birds and non-avian vertebrates extracted from pellets. The number of individual birds identified as a percent of all vertebrates is greater on islands ( $\bar{X} = 10.5$ ) than on the mainland ( $\bar{X} = 4.0$ ). Thus, barn-owls on islands prey proportionately more on birds than other vertebrates (mainly mammals), than at mainland sites.

Some published accounts are of interest because of the extremes (0-100%) of avian prey taken by barn-owls. For example, mainland areas from which no birds were reported include California (Foster 1927: 6 of 11 sites; Hawbecker 1945; Fitch 1947), Massachusetts (Boyd and Shriner 1954), South Carolina (Tedards 1963: one of four seasonal samples),

Table 1. A comparison of vertebrate prey of Common Barn-Owls between mainland and island sites.

PREY	MAINLAND <sup>a</sup>	ISLANDS <sup>b</sup>
All vertebrate species	$\bar{X} = 10.7$ ; SD = 4.84 (U = 743; $P = 0.30$ )	$\bar{X} = 8.6$ ; SD = 5.40
All bird species	$\bar{X} = 2.6$ ; SD = 2.57 (U = 482; $P = 0.318$ )	$\bar{X} = 3.9$ ; SD = 4.39
All mammal species	$\bar{X} = 8.0$ ; SD = 3.26 (U = 941; $P < 0.0005$ )	$\bar{X} = 4.4$ ; SD = 1.82
Number of bird species as percent of all vertebrate species	$\bar{X} = 19.9$ ; SD = 16.52 (U = 312; $P < 0.01$ )	$\bar{X} = 38.6$ ; SD = 24.63
Number of individual birds as percent of all vertebrate individuals	$\bar{X} = 4.0$ ; SD = 6.51 (U = 284; $P = 0.008$ )	$\bar{X} = 10.5$ ; SD = 14.34

<sup>a</sup> Data from 50 sites: references 1, 2, 7, 10, 14, 16, 17, 18, 20, 22, 23, 25, 26, 27, 28, 29, 30, 33, 36, 37, 38, 39, 41, 42, 43, 44, 46, 47, 49, 50, 51, 52, 53, 54, 55; D. Glue (unpubl. data).

<sup>b</sup> Data from 23 sites: references 4, 5, 8, 11, 12, 13, 15, 21, 34, 56; D. Glue (unpubl. data); G. Jones and K. Driscoll (unpubl. data), Appendix I.

and Ireland (Fairley 1966: two of 10 seasonal samples). Island studies reporting no birds were those from Skomer (Brown and Twigg 1971), Bute (D. E. Glue, pers. comm.), and Martha's Vineyard (Choate 1972). At the other extreme, on some islands where extensive colonies of seabirds occur, barn-owls fed exclusively on birds (Bonnot 1928). The "outlier" or anomalous points in Figure 1 (60 units at 25°N) and Figure 2 (51 units at 25°N) came from the small and perhaps inadequate sample of Banks (1963) wherein the "remains of at least six Craveri Murrelets [*Brachyramphus craveri*] and at least four wood rats . . . , were identified."

**Latitudinal Variation.** We searched for relationships between latitude and bird prey in barn-owl diets using covariance analysis of the transformed percentages of vertebrate prey species that were birds (Fig. 1). ANCOVA indicated that a simple linear model is an adequate description for both the island and mainland data ( $P > 0.05$ ). The slopes of the regression lines were significantly different from zero ( $P = 0.05$ ), but there was no evidence that the two slopes were different from each other even though the  $y$ -axis intercepts were significantly different ( $P < 0.05$ ). Considering numbers of species found in pellets, effects of latitude were, therefore, the same on islands and the mainland. Toward the equator bird species comprised a significantly greater percentage of vertebrate prey species than at higher northern latitudes, although no comparable data were available for mainland sites from 0°–25°N. The best estimate of a common slope (islands and mainland) was that bird species in barn-owl diets decrease by approximately 6.2% for each 10° latitude northward.

By examining only mainland data for barn-owls in Europe, Herrera (1974) proposed a latitudinal effect and used a modification of the now-questionable (Pielou 1977) Shannon-Wiener diversity index, namely "trophic diversity in relation to biomass" of prey captured. Herrera's report, although not strictly comparable to the present study which focuses on avian prey selection, noted a significant negative correlation between trophic diversity in relation to biomass and north latitude.

Although the effects of latitude were the same for islands and mainland sites, the greater percentages of bird species taken on islands compared with mainland sites at the same latitude merit comment. We believe that this difference is due, at least in part, to the different relative numbers of available prey species, especially birds vs. small mammals. Such comparisons are often impossible to document and quantify because of the lack of published information on numbers of available species. On Grand Cayman at 19°N where barn-owl diets included about 60% bird species, only 5 small mammal species including 3 bats occur, whereas about 70 passerine bird species have been identified (Johnston 1974 and pers. obs.)

Regression lines for percentages of individual birds in the prey items also show a negative correlation with latitude but the  $y$ -intercepts are not significantly different from each other (Fig. 2). The best estimate for a common slope is a decrease in individual birds of approximately 7.3% for each 10° latitude northward.

Our analysis demonstrates that barn-owls prey 1) on proportionately more avian species and individual birds on islands than on the mainland and

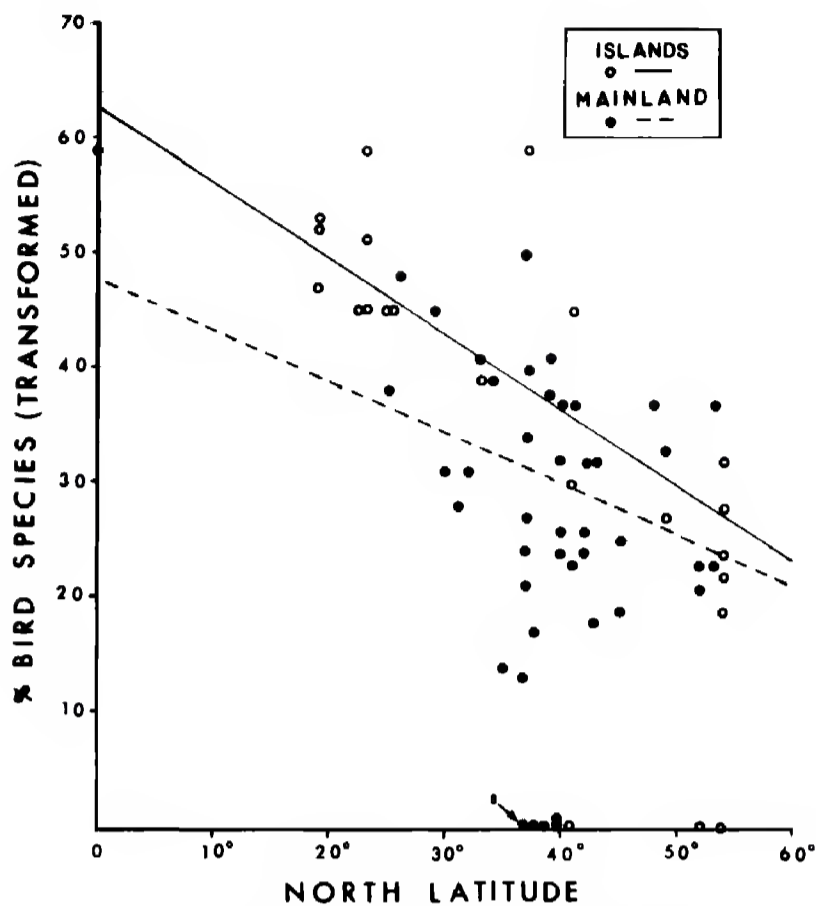


Figure 1. The relationship between degrees of north latitude and the percent of bird species among all vertebrate species of prey found in Common Barn-Owl pellets from islands and mainland sites. Percentages have been transformed (arc-sine of  $\sqrt{x}$ ; see Sokal and Rohlf 1981). Individual data points are from references cited in Table 1.

2) on fewer birds with increasing latitude northward. These differences raise questions on the causes of dietary preferences. Is it because mammalian faunas on islands are more depauperate? From 11 islands for which mammal data were available, the mean number of mammalian prey species was eight, whereas the mean number from 13 mainland sites was 10, suggesting a decrease in mammalian species richness on islands. Unfortunately, a fundamental and perhaps crucial data set was lacking in all these studies, namely population densities of all available prey species. We do not have convincing evidence to know if barn-owls capture prey in proportion to the number of individuals present in the foraging area. Furthermore, we do not know the barn-owl's feeding efficiency. Is it, for example, more efficient for an owl to capture a small bird than a large rat, bat or shrew?

Finally, for our analyses of prey captured by barn-owls, it appears that this predator-prey system is at least a qualitative example of optimal foraging theory. When and if small mammal populations are

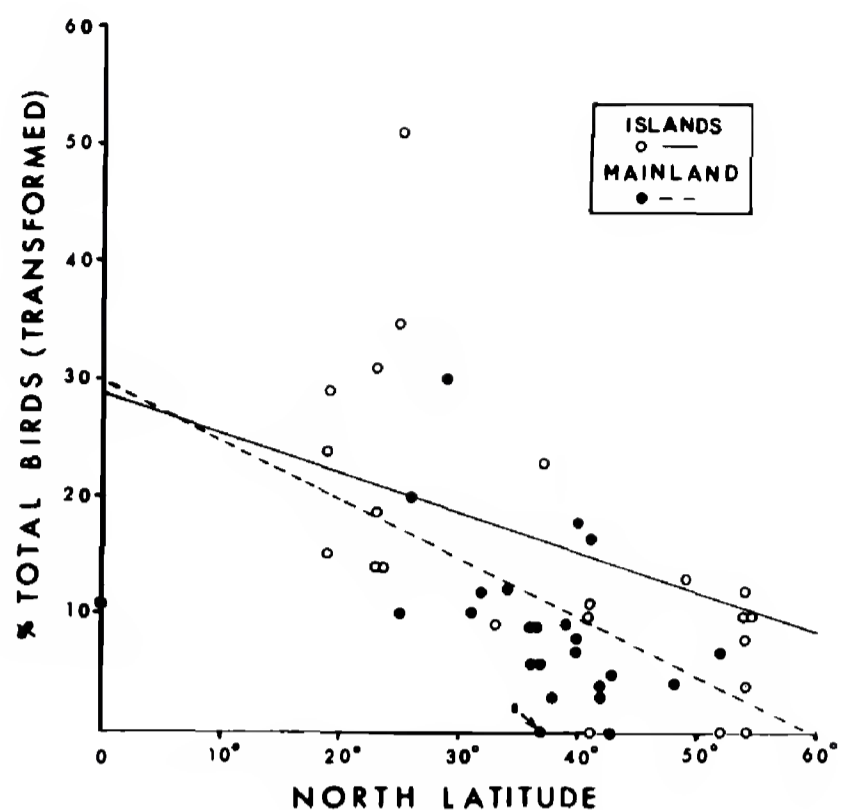


Figure 2. The relationships between degrees of north latitude and the percent of total birds among all vertebrate prey found in Common Barn-Owl pellets from islands and mainland sites. Percentages have been transformed (arc-sine of  $\sqrt{x}$ ). Individual data points are from references cited in Table 1.

reduced in diversity or abundance on islands, barn-owls are believed to take alternative prey to maximize their energy input.

ACKNOWLEDGMENTS

Unpublished data were supplied by D. E. Glue, Gwilym Jones, and Karen Driscoll. James W. Haefner and Stephan R. Taub kindly offered statistical advice and earlier drafts were read by Brian Millsap, Dan Anderson, Peter Grant, Dennis Power, and Carl Marti. Their critical suggestions helped to improve the manuscript. A grant from George Mason University supported prey identifications from Block Island. We are grateful to Susan R. Drennan who collected the pellets from Block Island.

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\* Numbers in parentheses following each citation identify references used in the analyses.

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Received 30 September 1986; Accepted 20 January 1987

Appendix I. Prey remains from Common Barn-Owl pellets, Block Island, RI (41°11'N, 71°34'W).

	4-5 OCTOBER 1980	1981	
		10-11 JANUARY	9-10 MAY
Number of whole pellets	26	18	16
<i>Microtus pennsylvanicus</i>	63 (51%)	42 (68%)	11 (38%)
<i>Rattus norvegicus</i>	12 (10%)	1 (2%)	6 (21%)
<i>Peromyscus leucopus</i>	46 (37%)	18 (29%)	10 (34%)
<i>Hylocichla</i> sp. <sup>a</sup>	—	—	1 (3.5%)
<i>Dumetella carolinensis</i> <sup>a</sup>	1 (0.5%)	—	1 (3.5%)
Unidentified passerine birds <sup>a</sup>	2 (1.5%)	1 (1%)	—

<sup>a</sup> Identifications by Pierce Brodtkorb.

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